APPLICATION		REVISIONS			
NEXT ASSY	FINAL ASSY	LTR	DESCRIPTION	DATE	APPROVED
FINAL		-	PRODUCTION RELEASE/E.O. 17162	7/7/89	
		A	REVISED & REDRAWN/E.O. 24516	12-18-89	

LIQUID CRYSTAL DISPLAY MODULE

4 X 40 CHARACTER

WITH GREEN E.L. BACKLIGHT

S03857-21-[illegible] -20° VIEWING ANGLE

S03857-22- $+20^{\circ}$ VIEWING ANGLE

REV	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A						
SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

REVISION STATUS

PROJ. NO. 411	CONTRACT	INDUSTRIAL ELECTRONIC ENGINEERS, INC. VAN NUYS, CALIFORNIA	
	DRAWN	LCD MODULE, 4 X 40 W/GREEN E.L. BACKLIGHT	
	CHECK 7/7/89		
	APPROVED	SIZE A / CODE IDENT NO. 05464	S03857-21,-22
	APPROVED 7-7-89	SCALE	SHEET 1 OF 24

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1.0 GENERAL INFORMATION

1.1 Introduction

This specification describes the Daystar Nova modules 03857-21 and 03857-22, 4-line liquid crystal displays (LCD's) with 40 characters per line and green EL backlights.

1.2 Application

Daystar Nova modules provide alphanumeric information which is easily readable in high ambient light or in darkness with an electroluminescent backlight. The low power requirements of the modules make them suitable for portable battery operated equipment. The wide operating temperature range (-30° to +85°C) is ideal for most outdoor applications. A choice of the preferential viewing hemisphere is provided. The 03857-21 module is intended for bottom view applications and the 03857-22 module for top view.

1.3 Description

The Daystar Nova module is a self-contained 1/16 multiplexed unit. A simple parallel interface is provided and can be configured as either 4 or 8 bits. Two on-board microprocessors control the display, multiplexing and character decoding. The temperature compensation circuitry guarantees that the viewing characteristics are optimized for all temperatures.

The on-board character generator ROM generates 192 types of alphanumeric, numeric, katakana characters and symbols. In addition, a character generator RAM allows the user to define eight additional characters.

A variety of high level functions allow the programmer to operate the display with simple and straightforward software routines. One such feature automatically increments the character display position after each character is written.

A green electroluminescent (EL) backlight is mounted behind the LCD to allow for low light level operation. An EL inverter can be ordered separately.

A single +5 volt nominal power supply is required for operation of the LCD module. The unit operates from 4.50 volts to 5.50 volts. The typical power requirement for the module without the EL backlight illuminated is 60mW.

The module weighs 10.5 oz. (297 g).

2.0 LOGICAL STRUCTURE AND FUNCTION

2.1 Module Block Diagram

FIGURE 1 illustrates the major components of the Daystar Nova module. The microprocessor controls all multiplexing and character decoding. The temperature compensation network optimizes both viewing and contrast ratio for the display over all operating temperatures. The EL power converter (separately available) generates the proper voltage for operation of the backlight.

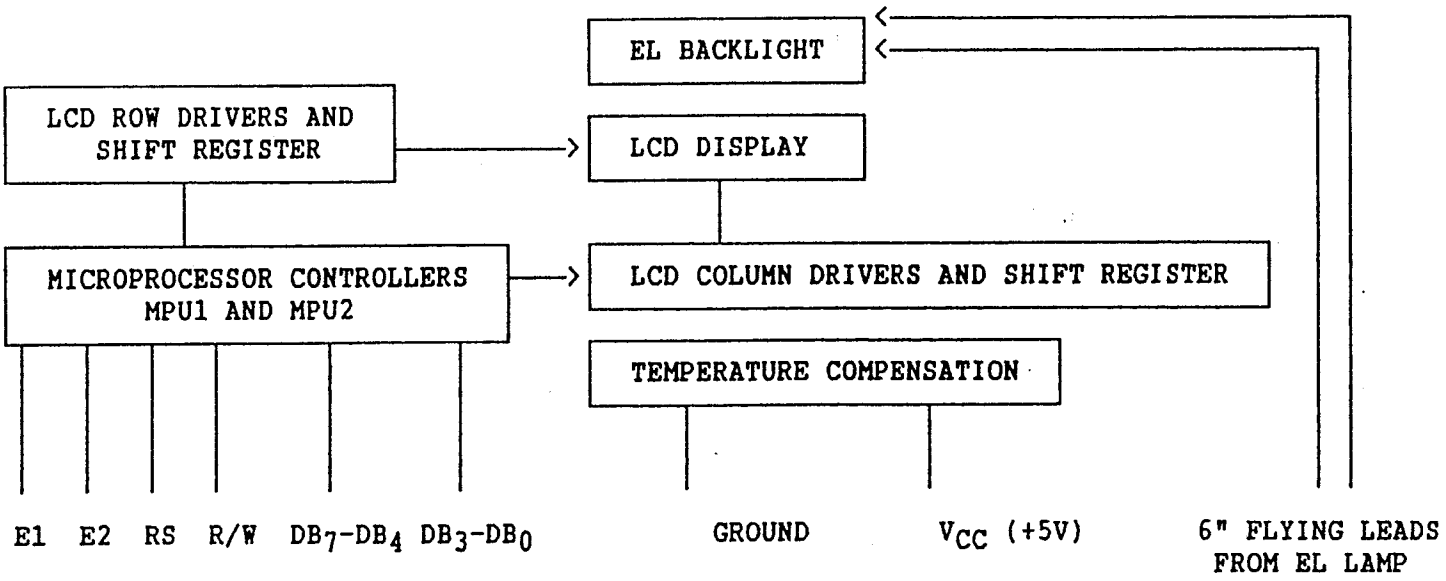


FIGURE 1

2.1.1 Signal Description

SIGNAL NAME	NUMBER OF LINES	INPUT/OUTPUT	CONNECTED
RS	1	I	MPU1/MPU2
R/W	1	I	MPU1/MPU2
E1	1	I	MPU1
E2	1	I	MPU2
DB4-DB7	4	I/O	MPU1/MPU2
DB0-DB3	4	I/O	MPU1/MPU2
Vcc	2	-	POWER
GND	7	-	-

2.2 Microprocessor Block Diagram

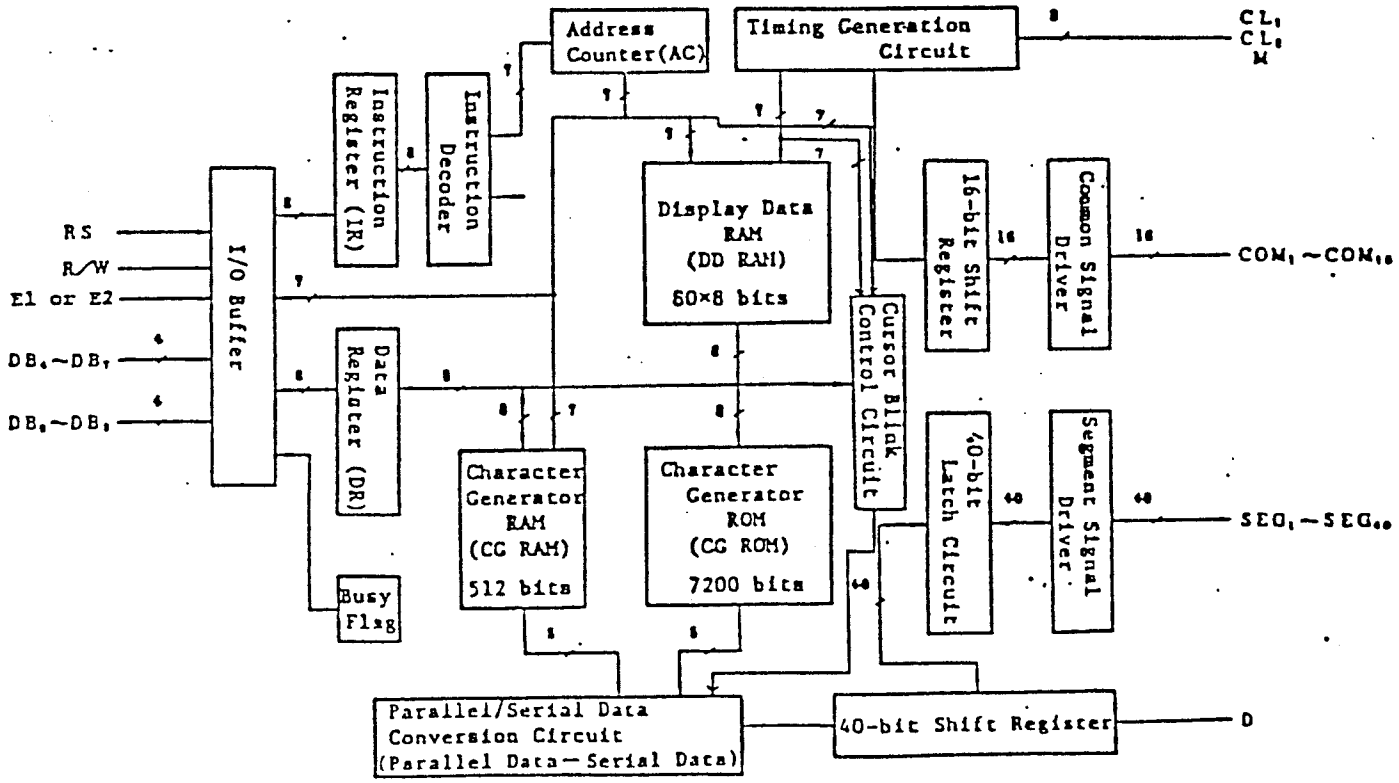


FIGURE 2

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S03857-21,-22
	SCALE	REV A	SHEET 5

2.2.1 Instruction Register (IR)

The IR stores instruction codes such as **display clear** and **cursor shift**, and address information of the display data RAM (DD RAM) and character generator RAM (CG RAM). The IR can be written from the MPU, but not read.

2.2.2 Data Register (DR)

The DR temporarily stores data to be written into or read from the DD RAM or the CG RAM.

2.2.3 Busy Flag

When the Busy Flag is a "1", the module is in an internal operating mode and ignores any additional instructions (Refer to **Read Busy Flag and Address** instruction).

2.2.4 Address Counter (AC)

The AC determines the address of the DD RAM or CG RAM in which new data is stored. After writing into (or reading from) the DD RAM or CG RAM, the AC is incremented or decremented as defined by the Increment/Decrement bit (Refer to **Entry Mode Set** instruction).

2.2.5 Display Data RAM (DD RAM)

The DD RAM contains 80 X 8 bits and represents 80 characters. The relationship between the DD RAM address and position of the characters in the display can be controlled by the user (Refer to **Entry Mode Set** and **Cursor or Display Shift** instructions).

2.2.6 Character Generator ROM (CG ROM)

The CG ROM generates character patterns of 5 X 7 dots from 8 bit character codes. The 192 5 X 7 dot matrix characters are illustrated in FIGURE 3.

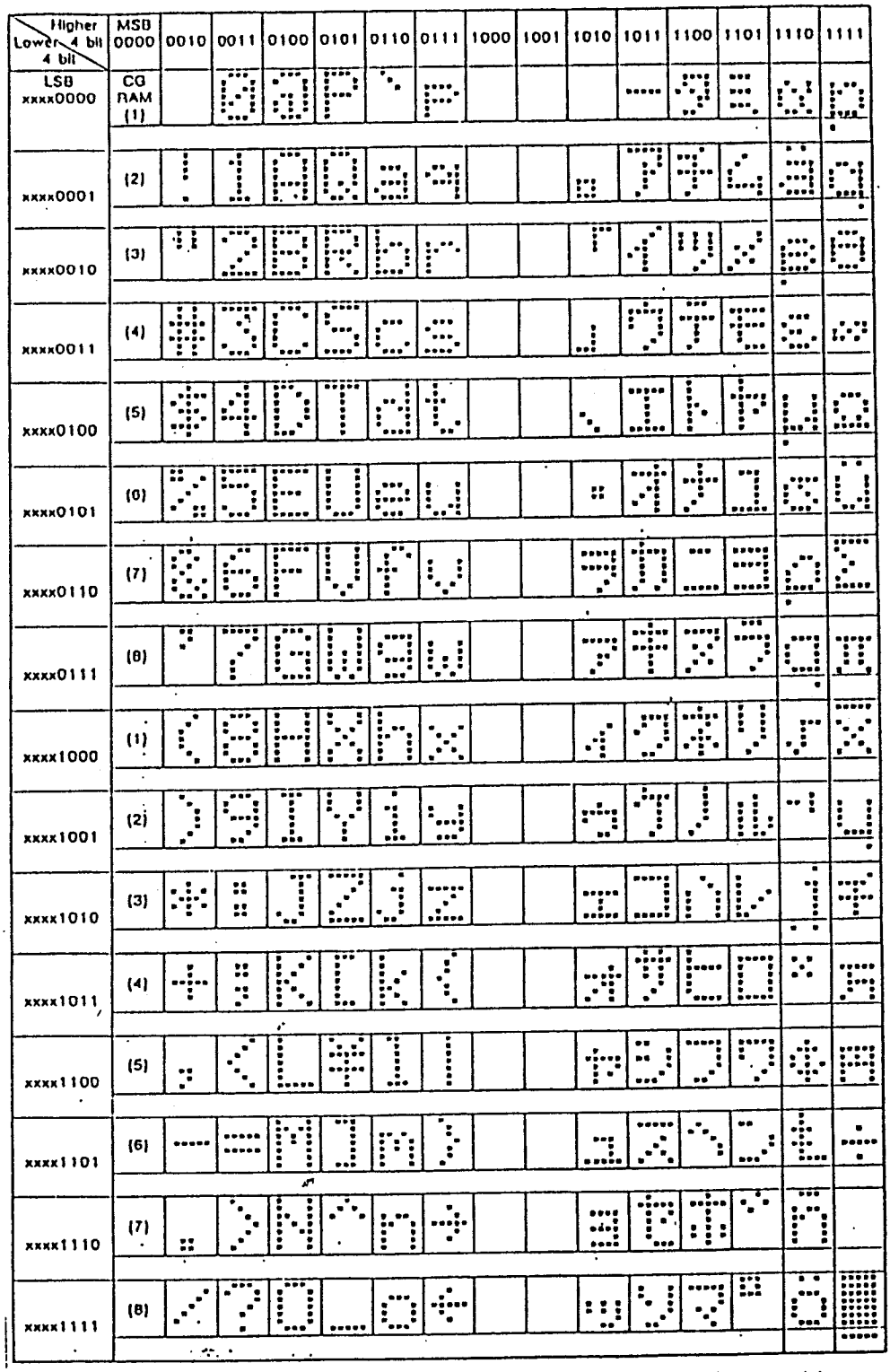


FIGURE 3 - Correspondence between Character Codes and Character Pattern

2.2.7 Character Generator RAM (CG RAM)

The CG RAM allows the user to define 8 types of 5 X 7 character patterns. FIGURE 4 shows the relationship between CG RAM addresses and data patterns (Refer to **Set CG RAM Address** and **Write to CG or DD RAM** instructions).

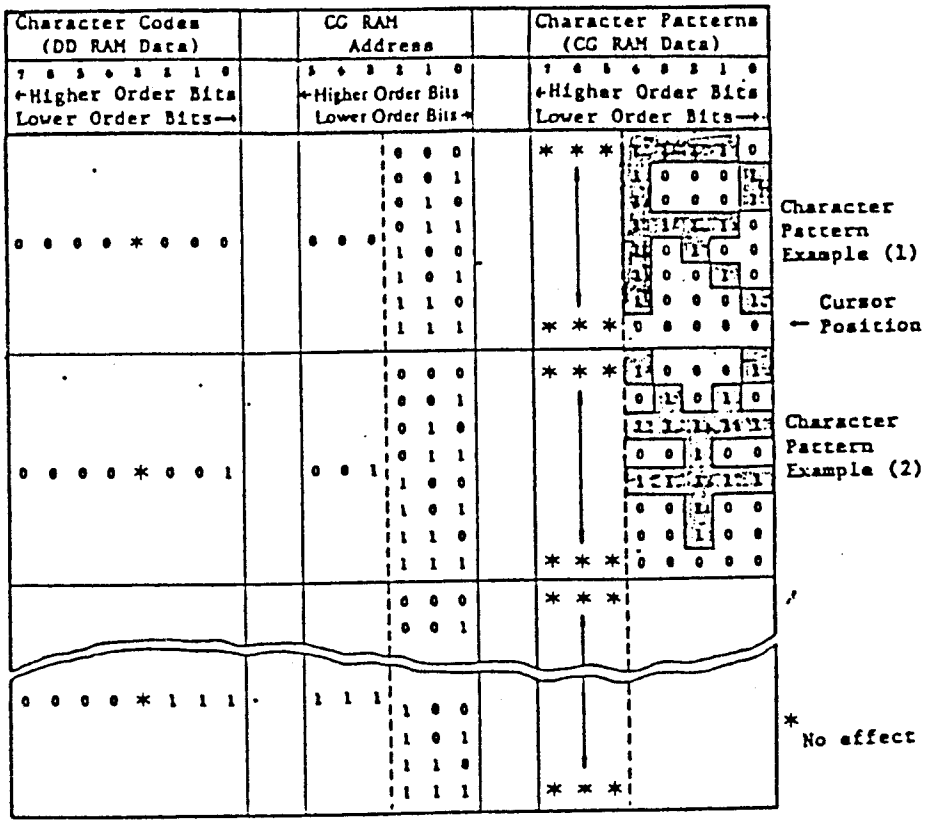


FIGURE 4 - Relation between CG RAM Addresses and Character Codes (DD RAM) and Character Patterns (CG RAM Data)

NOTES:

1) The CG RAM consists of 64 bytes. Any bytes not used for character pattern information can be used for general purpose data RAM. The 5, 6 and 7 bits are never used for character pattern information and are always available for use.

2) The 0, 1 and 2 bits of character code correspond to the 3, 4 and 5 bits of the CG RAM address.

3) The 0, 1 and 2 bits of the CG RAM address specify the row of the character pattern.

4) The 8th row of the character pattern corresponds to the cursor character pattern. If any bit in the row is "1", then the corresponding cursor bit is a "1" regardless of cursor position. (For most applications, the data should be "0" in this row, which allows for normal cursor operation on the character.)

5) Since bit 3 is a "don't care", two character codes represent the same special character. For example, a character code of 07 (hexadecimal) selects the same character pattern as 0F (hexadecimal).

2.2.8 Parallel/Serial Data Conversion Circuitry, Timing Generator Circuitry

These blocks control the interface to the LCD drivers.

3.0 OPERATION

3.1 Dual MPU Operation

Two on-board microprocessors control the display multiplexing and character decoding. MPU1 controls the upper two lines of the 4 line display and MPU2 controls the lower two lines. Both MPU's share two control signals and a data bus. The host system can select either MPU by their respective ENABLE signal, E1 or E2. The host system can only perform a read or write operation with one MPU at any given time. To avoid any bus contention, the ENABLE signal of the unselected MPU must be held low during read and write operations to the selected MPU.

3.2 Instruction Set

INSTRUCTION	CODE										DESCRIPTION	EXECUTION TIME (MAX)
	RS	R/W	DB_7	DB_6	DB_5	DB_4	DB_3	DB_2	DB_1	DB_0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Clears entire display and sets DD RAM counter to 0.	1.64ms
Return Home	0	0	0	0	0	0	0	0	1	*	Sets DD RAM counter to 0. If the display has been shifted, the characters are returned to their initial positions. DD RAM contents are unchanged.	1.64ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets the shift direction and cursor movement direction which occur during data read and write operations.	40us
Display ON/OFF Control	0	0	0	0	0	0	1	D	C	B	Turns ON/OFF the entire display (D), ON/OFF cursor (C), and ON/OFF of cursor blink attribute (B).	40us
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	*	*	Moves cursor or shifts entire display one position. DD RAM contents are unchanged.	40us
Function Set	0	0	0	0	1	DL	1	0	*	*	Sets interface data length (DL).	40us
Set CG RAM Address	0	0	0	1	A_{CG}						Sets CG RAM address. CG RAM data is sent or received after this setting.	40us
Set DD RAM Address	0	0	1	A_{DD}							Sets DD RAM address. DD RAM data is sent or received after this setting.	40us
Read Busy Flag & Address	0	1	BF	AC							Reads Busy Flag (BF) and Address Counter (AC).	0us
Write Data to CG or DD RAM	1	0	Write Data								Writes data into DD RAM or CG RAM.	40us
Read Data from CG or DD RAM	1	1	Read Data								Reads data from DD RAM or CG RAM.	40us

I/D=1: Increment
I/D=0: Decrement
S=1 : Enable Shift Operation
S/C=1: Shift Display
S/C=0: Shift Cursor
R/L=1: Shift to the right.
R/L=0: Shift to the left.
DL=1 : 8 bits; DL=0: 4 bits
BF=1 : Internally operating
BF=0 : Can accept instruction

DD RAM: Display data RAM
CG RAM: Character generator RAM
A_{CG} : CG RAM address
A_{DD} : DD RAM address. Corresponds to cursor address.
AC : Address counter used for both DD and CG RAM addresses.
* : Don't Care

FIGURE 5

3.3 Power Up Instructions Sequence

Upon power up, the Daystar Nova module is set to a default mode of operation. Under some power up circumstances, the default mode may be improperly set. Consequently, the following instructions should always be executed in the host systems initialization routine.

STEP	OPERATION
1.	Function Set for 8 bits
2.	Repeat, Function Set for 8 bits
3.	Function Set
4.	Clear Display
5.	Entry Mode Set
6.	Display On/Off Control

STEP	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1.	0	0	0	0	1	1	*	*	*	*
2.	0	0	0	0	1	1	*	*	*	*
3.	0	0	0	0	1	DL	1	0	*	*
4.	0	0	0	0	0	0	0	0	0	1
5.	0	0	0	0	0	0	0	1	I/D	S
6.	0	0	0	0	0	0	1	D	C	B

Refer to instruction set for values of DL, I/D, S, D, C and B. (* Don't care)

3.4 Instructions Affecting the Relationship of Display Position, Cursor, and DD RAM Address

The DD RAM contains the 8 bit character codes of the 40 characters displayed on the Daystar Nova LCD. The **Cursor or Display Shift** instruction and the **Write to DD RAM** and **Entry Mode** instructions affect the relationship between DD RAM address and display position. FIGURES 6 to 10 illustrate the effects of these instructions.

MPU1	00*	01	02	03	04	05	06	07	08	09	0A		22	23	24	25	26	27
	40	41	42	43	44	45	46	47	48	49	4A		62	63	64	65	66	67
MPU2	00*	01	02	03	04	05	06	07	08	09	0A		22	23	24	25	26	27
	40	41	42	43	44	45	46	47	48	49	4A		62	63	64	65	66	67

* = CURSOR

FIGURE 6 - Initial Conditions upon Power Up

. 3.4 Instructions Affecting the Relationship of Display Position, Cursor, and DD RAM Address (Continued)

MPU1	01	02	03	04	05	06	07	08	09	0A	0B		23	24	25	26	27	00*
	41	42	43	44	45	46	47	48	49	4A	4B		63	64	65	66	67	40
MPU2	00*	01	02	03	04	05	06	07	08	09	0A		22	23	24	25	26	27
	40	41	42	43	44	45	46	47	48	49	4A		62	63	64	65	66	67

* = CURSOR

FIGURE 7 - Display Shift Left from Initial Conditions

MPU1	27	00*	01	02	03	04	05	06	07	08	09		21	22	23	24	25	26
	67	40	41	42	43	44	45	46	47	48	49		61	62	63	64	65	66
MPU2	00*	01	02	03	04	05	06	07	08	09	0A		22	23	24	25	26	27
	40	41	42	43	44	45	46	47	48	49	4A		62	63	64	65	66	67

* = CURSOR

FIGURE 8 - Display Shift Right from Initial Conditions

MPU1	01*	02	03	04	05	06	07	08	09	0A	0B		23	24	25	26	27	00#
	41	42	43	44	45	46	47	48	49	4A	4B		63	64	65	66	67	40
MPU2	00*	01	02	03	04	05	06	07	08	09	0A		22	23	24	25	26	27
	40	41	42	43	44	45	46	47	48	49	4A		62	63	64	65	66	67

* = CURSOR # = LAST CHARACTER ENTERED

FIGURE 9 - Load Character with S=1,I/D=0 from Initial Conditions

MPU1	27*	00#	01	02	03	04	05	06	07	08	09		21	22	23	24	25	26
	67	40	41	42	43	44	45	46	47	48	49		61	62	63	64	65	66
MPU2	00*	01	02	03	04	05	06	07	08	09	0A		22	23	24	25	26	27
	40	41	42	43	44	45	46	47	48	49	4A		62	63	64	65	66	67

* = CURSOR # = LAST CHARACTER ENTERED

FIGURE 10 - Load Character with S=1,I/D=1 from Initial Conditions

3.5 Instructions Affecting Custom Characters

The module allows the user to define 8 unique special characters. The pattern of the characters is stored in the CG RAM. The relationship between the CG RAM address and the character pattern is illustrated in FIGURE 4. The **Read Data from CG RAM**, **Write Data to CG RAM**, and **Set DD RAM** instructions provide for easy programmability.

4.0 ELECTRICAL SPECIFICATIONS

4.1 Absolute Maximum Rating

Power Supply Voltage (Vcc)	-0.3 to +6.5 volts
Input Voltage	-0.3 to +Vcc +0.3 volts
Storage Temperature	-40 to +85°C

4.2 Normal Operating Rating

Power Supply Voltage (Vcc)	+5.0V ±10%
Operating Temperature	
(Backlight OFF)	-30 to +85°C
(Backlight ON)	-30 to +40°C
(Refer to section 6.3.5)	
Humidity (≤ 40°C)	95% RH (non-condensing)
Humidity (≥ 40°C)	absolute humidity must be lower than the humidity of 95%RH at 40°C
Vibration (Operating)	10 G (all axes)
Shock (Operating)	10 G (all axes)

4.3 Electrical Characteristics (Vcc = 5V ±10%)

ITEM	SYMBOL	CONDITION	MIN	MAX	UNIT
Input "High" Voltage	V_{IH}		2.2	V_{CC}	V
Input "Low" Voltage	V_{IL}		-0.3	0.6	V
Output "High" Voltage (TTL)	V_{OH1}	I_{OH}=0.205mA	2.4	-	V
Output "Low" Voltage (TTL)	V_{OL1}	I_{OL}=1.2mA	-	0.4	V
Output "High" Voltage (CMOS)	V_{OH2}	IOH=0.04mA	0.9V_{CC}	-	V
Output "Low" Voltage (CMOS)	V_{OL2}	IOL=0.04mA	-	0.1V_{CC}	V
Input Leakage Current	I_{IL}	V_{IN}=0 to V_{CC}	-	0.001	mA
Supply Current (logic)	I_{CC}		6	12	mA

4.4 Timing Characteristics

Write Operation (Refer to FIGURE 11)

ITEM	SYMBOL	MIN	MAX	UNIT
Enable Cycle Time	t_{cyc}	1000	-	ns
Enable Pulse Width "High Level"	PW_{EH}	450	-	ns
Enable Rise/Fall Time	t_{Er}, t_{Ef}	-	25	ns
Address Set-up Time RS,R/W	t_{AS}	140	-	ns
Address Hold Time	t_{AH}	10	-	ns
Data Set-up Time	t_{DSW}	195	-	ns
Data Hold Time	t_{H}	10	-	ns

Read Operation (Refer to FIGURE 12)

ITEM	SYMBOL	MIN	MAX	UNIT
Enable Cycle Time	t_{cyc}	1000	-	ns
Enable Pulse Width "High Level"	PW_{EH}	450	-	ns
Enable Rise/Fall Time	t_{Er}, t_{Ef}	-	25	ns
Address Set-up Time RS,R/W	t_{AS}	140	-	ns
Address Hold Time	t_{AH}	10	-	ns
Data Delay Time	t_{DDR}	-	320	ns
Data Hold Time	t_{DHR}	20	-	ns

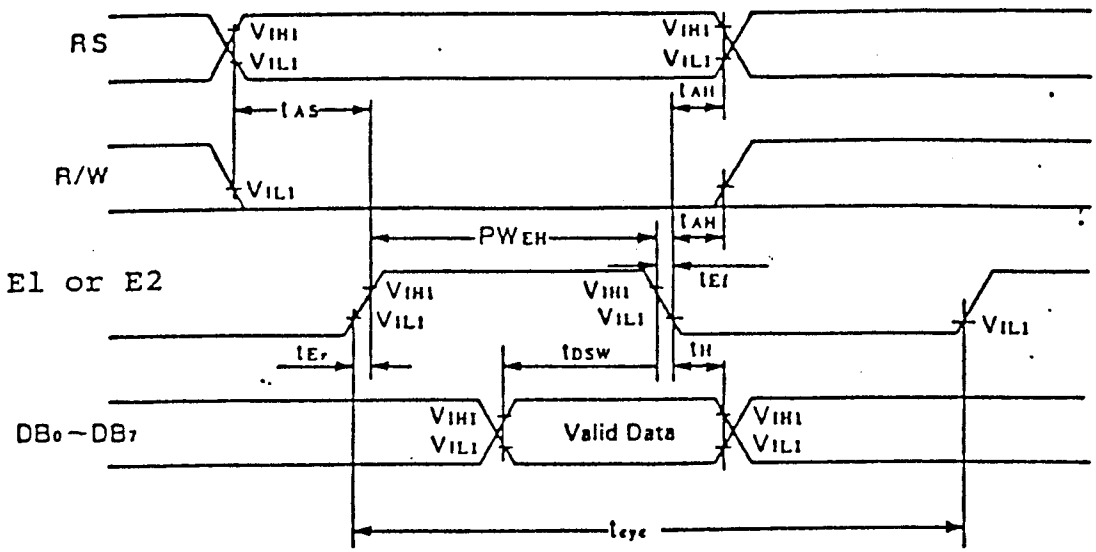


FIGURE 11 - Interface Timing (Write)

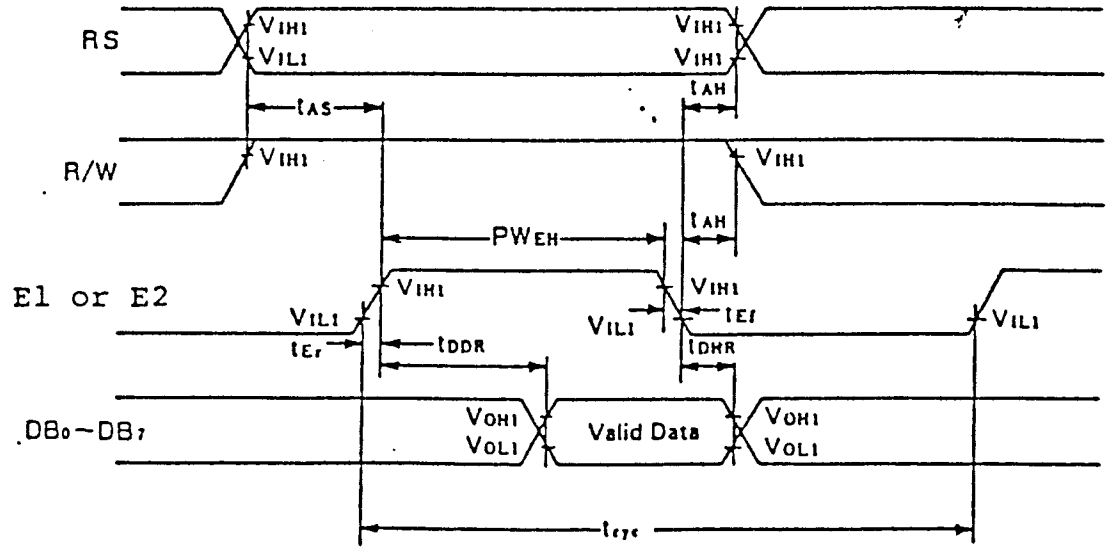


FIGURE 12 - Interface Timing (Read)

4.5 Timing Sequence for 8 Bit Parallel Interface

FIGURE 13 illustrates the typical Busy Flag check sequence for an 8 bit data interface.

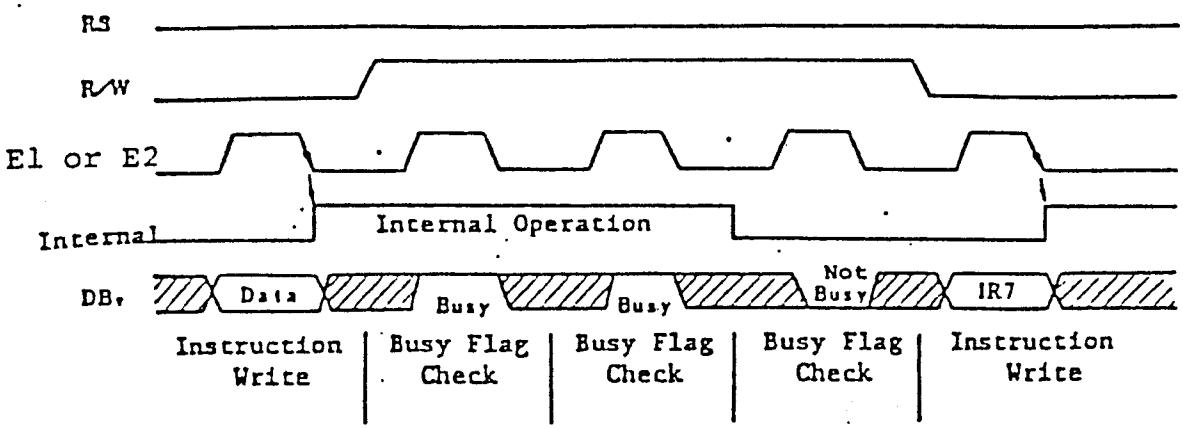
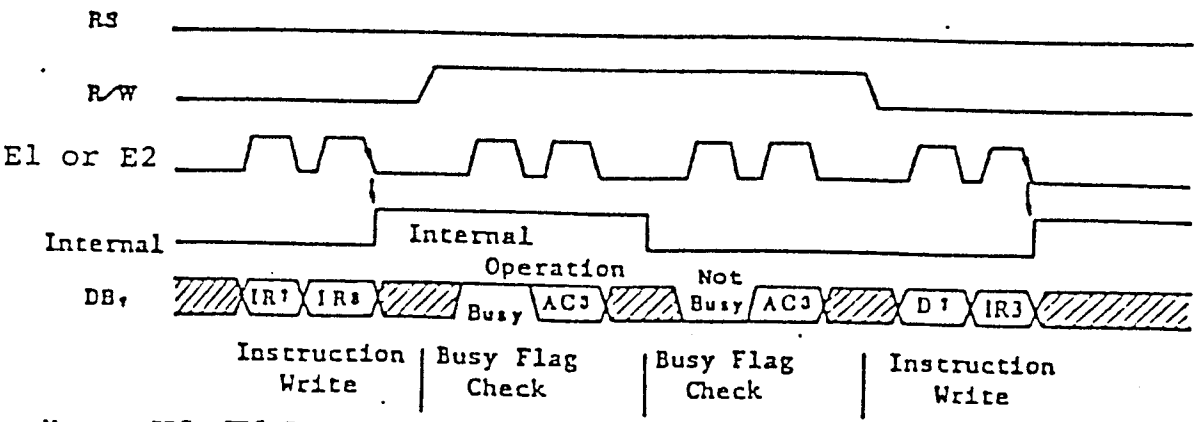


FIGURE 13

4.6 Timing Sequence for 4 Bit Parallel Interface

FIGURE 14 illustrates the typical Busy Flag check sequence for a 4 bit data bus interface.



Note : IR7, IR3: Instruction 7th bit, 3rd bit

AC3 : Address Counter 3rd bit

FIGURE 14

4.7 Connector Pin Assignments

PIN NO.	FUNCTION
1	NO CONNECTION
2	V_{BIAS}
3	ENABLE 2
4	ADJ (VIEWING ANGLE ADJUSTMENT)
5	R/W (READ=1)
6	KEY (PIN REMOVED)
7	RS
8	GROUND
9	ENABLE 1
10	GROUND
11	DB0
12	GROUND
13	DB1
14	GROUND
15	DB2
16	GROUND
17	DB3
18	GROUND
19	DB4
20	GROUND
21	DB5
22	V_{CC} (+5VDC), PARALLEL CONNECTION W/PIN 24
23	DB6
24	V_{CC} (+5VDC), PARALLEL CONNECTION W/PIN 22
25	DB7
26	NO CONNECTION

5.0 OPTICAL SPECIFICATIONS

5.1 Optical Characteristics

Format:	Four lines of 40 characters
Character Font:	5x7 dot matrix with cursor
Character Height w/ cursor:	.41" (10.4mm)
Character Height w/o cursor:	.34" (8.5mm)
Character Width:	.20" (5.0mm)
Overall Active Area:	9.79" x 2.03" (248.7mm x 51.5mm)
Peak Vertical Viewing Angle:	20° below normal plane (-21 modules) 20° above normal plane (-22 modules)
Viewing Mode:	Transflective, light field

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Viewing Angle-Vertical	$\phi 1-\phi 2$	K=1.5, θ=0°	40	50	-	deg.
Viewing Angle-Horizontal*	θ	K=1.5	±40	±45	-	deg.
Contrast ratio (Peak)**	K	25°C	-	8	-	-
Response time (ON)**	t_r	25°C	-	100	200	ms
		-30°C	-	1000	1200	ms
Response time (OFF)**	t_f	25°C	-	100	200	ms
		-30°C	-	1000	1200	ms

* Measured at peak vertical angle (typically ϕ=-20° for -21 modules and ϕ=+20° for -22 modules).

** Measured at peak viewing angles (typically θ=0°; ϕ=-20° for -21 modules and θ=0°; ϕ=+20° for -22 modules).

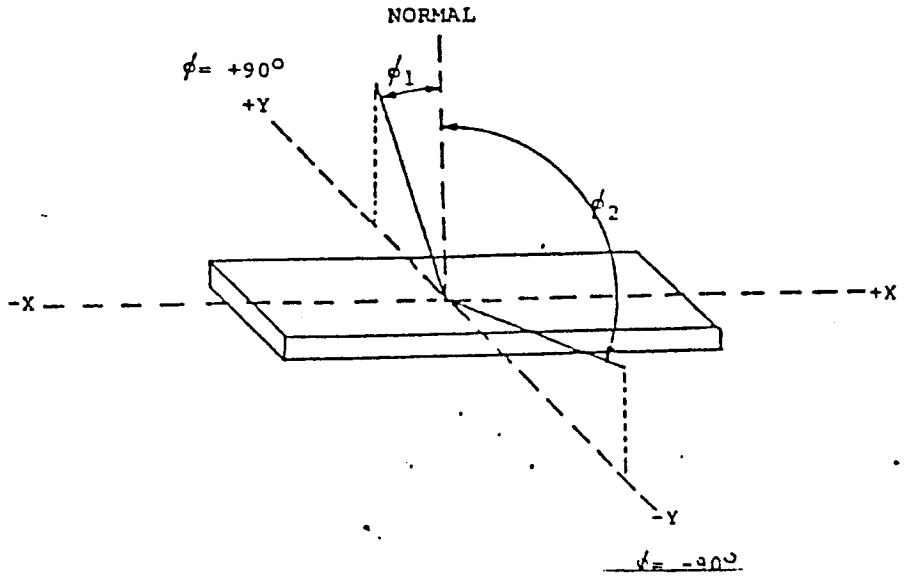


FIGURE 15 - Definition of Vertical Viewing Angle

5.1 Optical Characteristics (Continued)

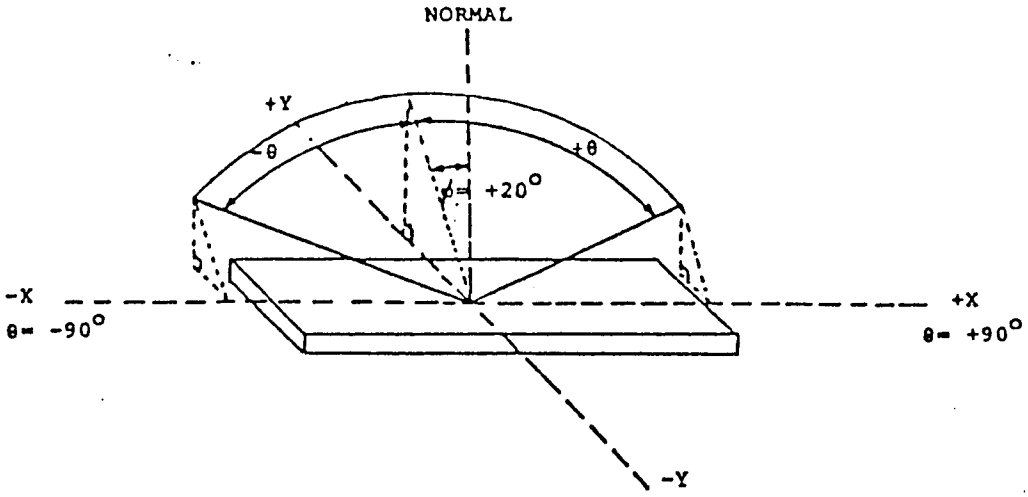


FIGURE 16 - Definition of Horizontal Viewing Angle-top Viewing Display (for Bottom Viewing Displays ϕ=-20° Typically)

$$K = \frac{\text{Brightness of non-selected segment } (B_2)}{\text{Brightness of selected segment } (B_1)}$$

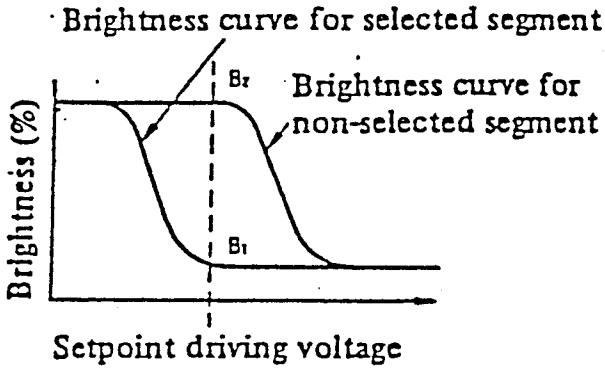


FIGURE 17 - Definition of Contrast Ratio "K"

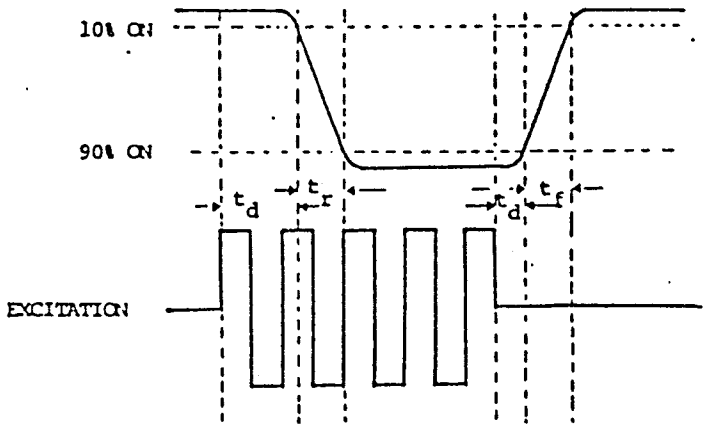


FIGURE 18 - Definition of Optical Response

5.2 Viewing Angle Adjustment

The factory preadjusts the viewing angle of the display by setting the LCD bias voltage to 8.0 volts using the on-board potentiometer. The bias voltage is measured between V_{CC} (pin #22) and V_{BIAS} (pin #2).

The viewing angle and contrast ratio may be externally controlled using an additional 10K ohm potentiometer. The potentiometer on the rear of the module must first be set to the maximum resistance by turning the adjustment fully counterclockwise. A 10K ohm potentiometer can then be connected between pin numbers 4 and 22 on the connector.

6.0 EL BACKLIGHTING

6.1 EL Backlight Description

The module contains an AC EL backlight which enables the LCD to read under low lighting conditions. The EL lamp provides uniform lighting across the entire display surface. Since the lamp is a cold light source, no heat is added to the module during operation.

6.2 Electrical Characteristics of EL Lamps

Typical measurements at 115VAC, 400Hz, unless otherwise noted.

Color:	Aviation Green
Radiance:	.051 Watts/ft^2
Spectral Peak Emission:	520mm
Chromaticity:	X = .230 ± .030, Y = .500 ± .030
Voltage Range:	41 to 130 volts
Operating Frequency (max.):	600Hz
Power Requirements:	.035 watts/inch^2

6.3 Operation

6.3.1 Normal Operation

The EL lamp is designed for typical operation at 90 volts AC at 330 cycles. The light output of the lamp under these operating conditions is typically 12 ft-L. Since the LCD transmits approximately 8% of the light, the light output through the display is 1 ft-L.

6.3.2 Brightness, Voltage, and Frequency Characteristics

Other voltages and frequencies can be applied to the lamp to increase or decrease the light output. FIGURE 19 illustrates the relationship between brightness and voltage. FIGURE 20 illustrates the relationship between brightness and frequency. A rough approximation of the initial brightness of an aviation green electroluminescent panel when driven by a sinusoidal waveform can be derived by the following equation.

$$B = 0.27 \times V + 0.0455 \times f - 27.7$$

where;

B = brightness of lamp in ft-L
V = Voltage applied to lamp in RMS volts
f = Frequency in hertz

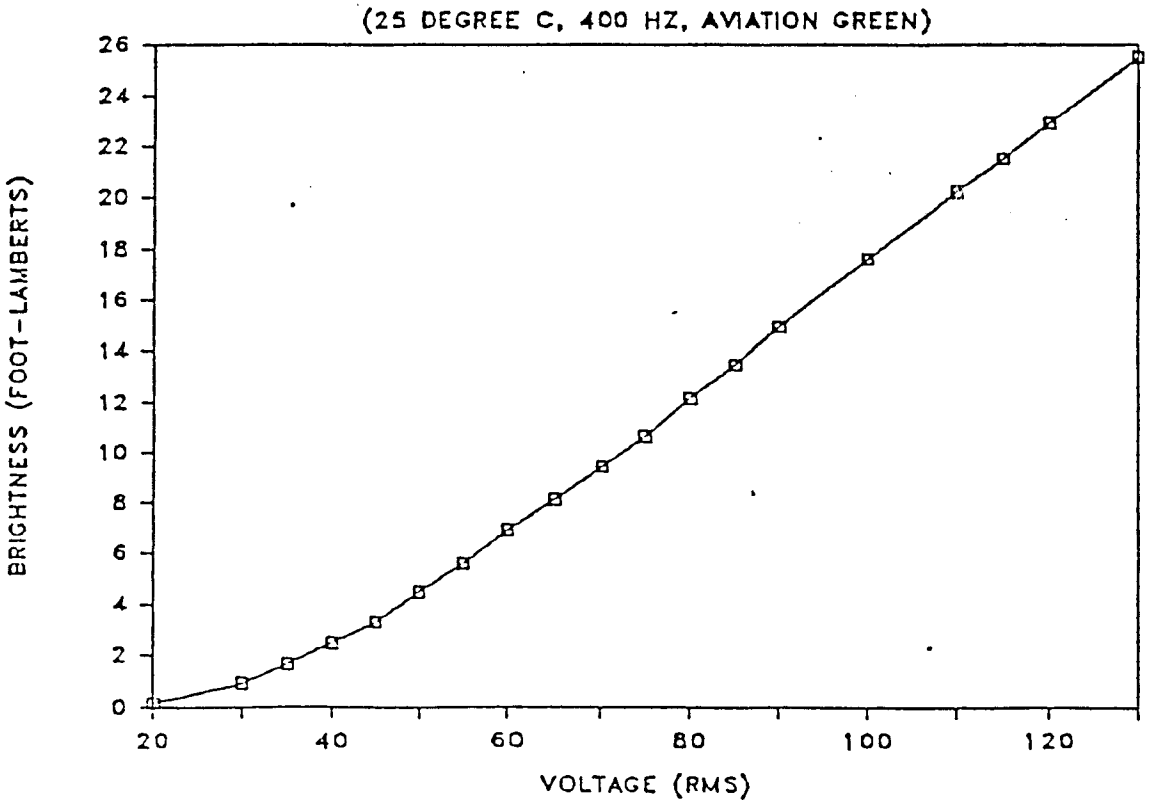


FIGURE 19 - Initial Brightness and Voltage

6.3.2 Brightness, Voltage, and Frequency Characteristics (Continued)

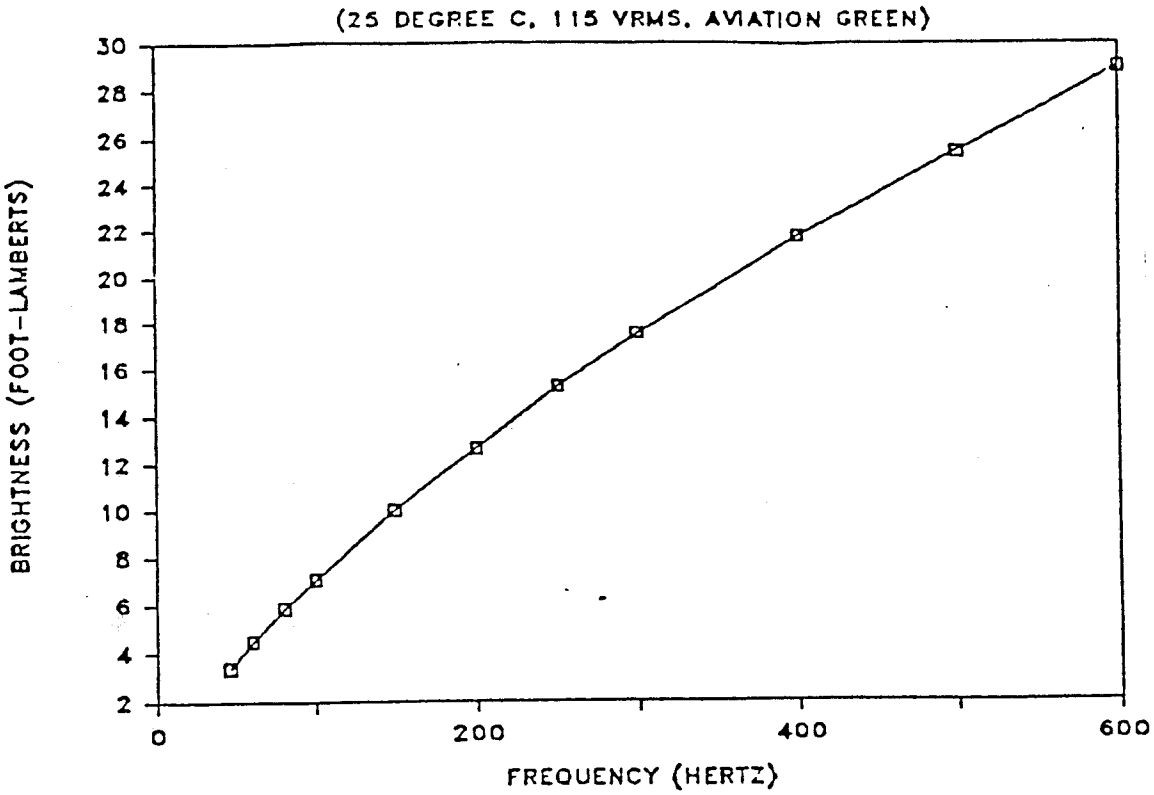


FIGURE 20 - Initial Brightness and Frequency

6.3.3 Intermittent Operation

The EL backlight is intended for intermittent usage only. Continuous operation will result in greatly reduced life of the lamp. The user is cautioned to observe the notes in Section 6.3.5 and 6.3.6 to assure maximum lifetime of the EL backlight.

6.3.4 Square Waveform Operation

Square wave operation is not recommended for EL lamps. First, square wave operation can result in a non-uniform light emission over the surface of the lamp. This non-uniformity is a result of the relatively high sheet resistivity of the front electrode causing an attenuation of the high frequency components in the square wave as distance from the bus bar increases. Consequently, the waveform is rounded at distances away from the bus bar. Second, the leading edge of a square wave contains high order harmonics which may cause radio interference (EMI).

6.3.5 Operating Temperature

The maximum continuous operating temperature for the EL backlight is specified at 40°C. Service may be extended to 70°C at a sacrifice in life. At temperatures above 70°C, aging is so rapid that prolonged operation is impractical. The specified non-operating temperature range -40°C to +85°C.

6.3.6 Operating Life

One of the prominent characteristics of EL lamps is the gradual decrease in light output, or aging, which occurs during operation. The useful life of the EL lamp depends on the ambient lighting conditions for a particular application. Typical lifetimes of 2000 to 10000 hrs. should be expected for most applications. The life of a lamp is affected by a number of factors, including the particular EL phosphor, the drive parameters (voltage and frequency) and the temperature during operation.

FIGURE 21 shows the gradual decrease in EL light output over time at 25°C with the inverter specified in Section 6.5. The brightness values are measures of the lamp surface brightness. The transmitted light through the LCD is approximately 8% of the lamp surface brightness.

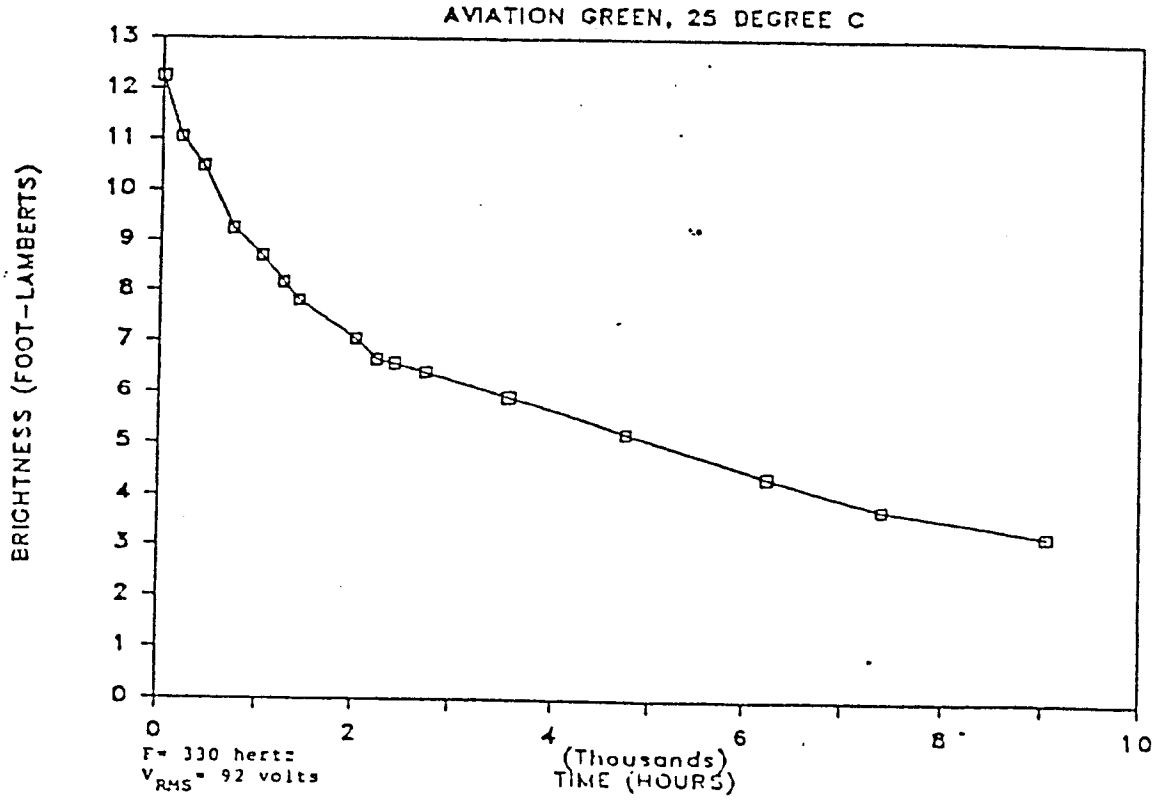


FIGURE 21 - Brightness vs. Time

6.4 Electromagnetic Interference (EMI)

Electroluminescent lamps have been shown to radiate negligible interference through UHF when operated by quasi-sinusoidal waveforms.

6.5 DC-AC Inverter

Optimum performance and life can be achieved by using the inverter #46320-01. The inverter extends ;the useful life of the lamp by compensating for the aging characteristics of the lamp. The inverter operates in a constant power mode which provides for long lifetime at a relative constant light output. Because of the quasi-sinusoidal output, RFI is minimal and usually no shielding is required.

7.0 ACCESSORIES

EL Power Inverter (5V INPUT) *	46320-01
Serial Data Converter Module (SDCM) (w/right angle male output connector)	29749-02
Serial Data Converter Module (SDCM) (w/straight-back female output connector)	29749-04
Input Power/Data Connector (8 pin) (for 24AWG to 28AWG) (for SDCM)	46555-08
Power/Data Connector Only (26 pin)	30554-99
Keyed Power/Data Connector with cable	30554-XX
Double ended keyed Power/Data cable (26 pin) (SDCM to Nova)	30553-XX

(XX = length in inches of cable)
(Standard cables are 18 and 36 inches)

* See application note AN31395-01.

8.0 OUTLINE DRAWING

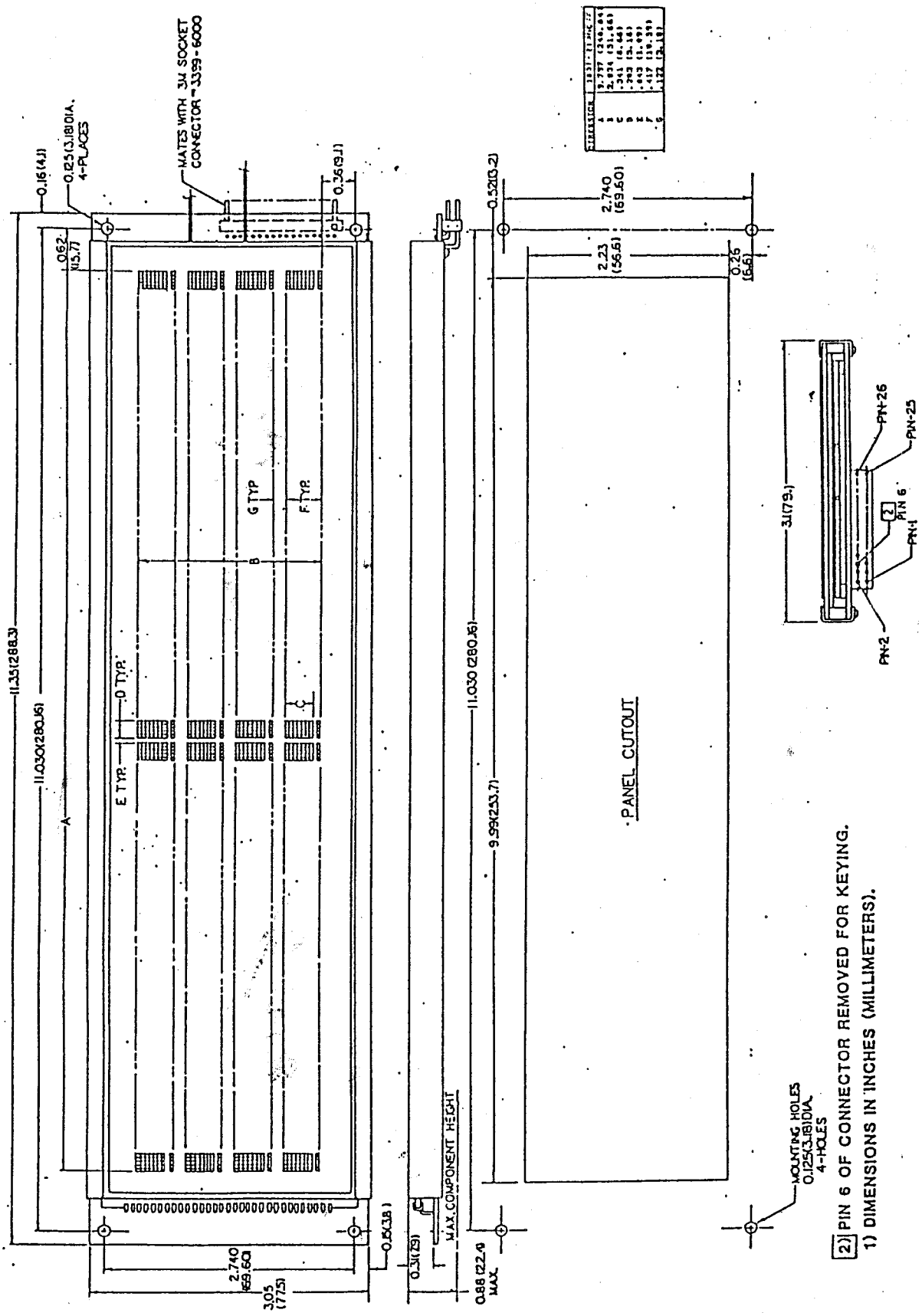


FIGURE 22

Industrial Electronic Engineers, Inc. **Van Nuys, California**	SIZE A	CODE IDENT NO. 05464	S03857-21,-22
	SCALE	REV A	SHEET 24